Future Directions in Global Change Research: A Workshop for Journalists

Meeting Summary

June 24, 1999
American Geophysical Union, Washington D.C.

NASA's Earth Observing System Project Science Office sponsored a two-day workshop for journalists on current issues in global change research and how the science will advance in the "Earth Observing System era."

The first day was devoted to talks by leading climate change researchers from around the country on such topics as global warming, the health of the oceans, and regional land and water impacts of climate change. The following is a summary of the presentations.

Welcome and Overview

V. Ramanathan, Scripps Institute of Oceanography

Ramanathan spoke about the reasons for having a science writers' workshop. He elaborated on NASA's Earth Observing System (EOS) mission and the links between Earth sciences and integrated systems. Some of the basic methods and measurements used in remote sensing were discussed.

NASA and the Future of Global Change Science

Ghassem Asrar, Office of Earth Science, NASA Headquarters

Asrar discussed the need for informing the public on the progress made in EOS science. The complexity of the issues at hand is a problem, and Asrar cited an American Geophysical Union (AGU) report on the public perception of environmental issues and the waning interest with respect to environmental issues. Asrar also gave a background of the history of NASA Earth-observing satellites from 1960 to future missions and talked about the shift in NASA to science-motivated research from technology-motivated research.

In response to questions, Asrar said: A 3.5% growth in NASA's $1.4 billion per year in the Earth science budget is expected when comparing FY99 to FY00 in the President's request. The space shuttle will be used for some measurements such as the Shuttle Topographic Radar Mission (SRTM). The total cost of Terra was $1.3 billion, QuikScat, $93 million and Triana, $75 million from the Earth Science Enterprise. Important Earth System Science results will be quickly forthcoming once Terra is launched, providing insights into our global environment.

Global Change Science Today

Charles Kennel, Scripps Institution of Oceanography

Kennel gave an overview of progress made in global change science and predictive capabilities including the understanding of ozone in the stratosphere and forecasting El Niño. Kennel admitted that scientists need to understand a great deal more before they're going to be able to say reliable things about global change. Kennel discussed a new integrated structure for studying Earth science including global collaboration.

In response to questions, Kennel said: New science results will be released every day and every year. In global sharing of information, there will be conflicts and there cannot be security of information. The process will depend on international exchange of data.

Global Climate Change: Uncertainties and Challenges

Jerry Mahlman, NOAA/GFDL, Princeton

Mahlman gave what he called, "A 20 minute tutorial that any science writer should have." The greenhouse effect occurs because the Earth's atmosphere has a number of infrared-absorbing constituents, i.e., carbon dioxide. It is the increase in carbon dioxide that is incontestably due to human activity.

Mahlman said that all the computer models agree that warming will occur and offered "Betting Odds" for the possibility of various global warm phenomena happening. He said that none of the uncertainties in various models make the problem of global warming go away.

In response to questions, Mahlman said: A Science paper by Wallace Broker that suggests there might be a flip-flop of the ocean circulation regime that would lead to cooling in the north Atlantic region has very low probability. discussing global cooling is not probable. It is a fact that adding greenhouse gasses directly heats up the planet. Specific events that are happening in different regions cannot be globalized. It's possible that paleoclimate teaches us that the climate system is very sensitive to warming. Colossal climate change could happen and take 10,000 years. The atmosphere may double pre-industrial CO2 concentrations by 2050.

Informing Policymakers on Global Change Science

Michael MacCracken, National Assessment Coordination Office of the US Global Change Research Program

MacCracken said that there are a range of different perspectives regarding the scientific findings about climate change. Fossil fuels supply about 80 to 90 percent of global energy, which in turn provides many benefits to society. From this perspective, before you disrupt the world's energy

system, there needs to be great certainty about the science. From the environmental or health risk perspective, however, we are performing an irreversible experiment with our planet and it is the uncertainties about what will happen that should make us cautious and take action to protect the planet. Other perspectives seeking to be heard are those focusing on the potential benefits of new energy technologies, those interested in comparing the near-term economic consequences of changing energy systems with the long-term benefits to the environment of slowing climate change, and the moral and equity-driven perspectives that focus on impacts on rich versus poor, the US versus the world, and this generation versus future generations.

The USGCRP is conducting a National Assessment of the potential consequences of climate variability and change (http://www.nacc.usgcrp.gov). This assessment is seeking to identify the ways in which climate change will affect agriculture, forests, water resources, human health, and coastal and marine resources across the nation and a range of additional sectors within about 15 regions around the country.

In response to questions, MacCracken said: The Intergovernmental Panel on Climate Change continues to be the focal point for international assessments, and the next reports due out focus on carbon sources and sinks. The general public is generally more interested in the local rather than the global impacts of climate change, which is one reason the national assessment has a strong regional focus. There is a real sense that climate change imposes a lot of stresses on coral reefs and other unique ecosystems.

NASA's Earth Observing System

Michael King, EOS Senior Project Scientist, NASA Goddard

King described the goals and mission objectives of NASA's Earth Observing System (EOS), placing particular emphasis on Landsat 7 (launched April 15, 1999) and Terra (expected to launch in Autumn 1999). QuikScat, launched last Saturday (June 19), carries the SeaWinds scatterometer instrument that will measure the surface wind speed and direction over the global oceans. Other missions under development are Earth Observing-1 (EO-1), ICESat-1, EOS PM, and EOS Chemistry.

King reported that dramatic images obtained from the NOAA Advanced Very High Resolution Radiometer (AVHRR) off the US west coast in summer often show signatures of ships at sea underneath marine stratocumulus clouds that contribute to making clouds brighter in the near-infrared. Ships emit sulfur dioxide as part of the burning of fossil fuel, and this gas is converted to sulfate particles in the atmosphere that modify clouds to produce a larger number of smaller cloud drops. These ship track-modified clouds then show up bright lines on the clouds when viewed in the near-infrared.

In response to questions, King explained the implications of these ship track observations on climate, namely that man-produced fossil fuel burning produces not only carbon dioxide, which leads to a warmer climate at the Earth's surface, but also produces sulfur dioxide that can make sulfate particles that contribute to pollution in a cloud-free atmosphere as well as modify clouds to

make them brighter in a low boundary-layer cloud atmosphere. Both of these effects have a somewhat mitigating effect on global warming by cooling the lower atmosphere, especially in the northern hemisphere.

Terra: A Global Change Observatory

Yoram J. Kaufman, Terra Project Scientist, NASA Goddard

Kaufman discussed EOS Terra as a new phase in Earth science. Earth system science requires high-resolution 4-dimensional measurements of: aerosols, biological productivity, clouds, fires, land use change, snow and ice, trace gases, water vapor and how they interact with one another. Kaufman discussed EOS Terra's overall objectives.

In response to questions, Kaufman said: What is new about EOS science is a global view of the Earth system at unprecedented spatial, spectral and temporal resolutions with precise, highly capable space-based sensors. Moreover, EOS offers dramatic improvements in data accessibility, data reduction, and data integration among multiple satellite sensors.

Global Warming and the Earth's Radiative Balance

David A. Randall, Colorado State University
James Hansen, NASA Goddard Institute for Space Studies

Randall discussed climate model development and the role of climate change. There are many aspects to the problem of the Earth's radiation budget, including the role of clouds. It is difficult to understand their effects on climate. Without clouds, the Earth emits less and clouds warm the Earth. Additional clouds cause more radiation to stay within the Earth's atmosphere.

Hansen said that global warming usually refers to an average temperature increase of the Earth, but regional changes can be quite different. There are several independent measures that confirm global warming. For example, glacier retreat has been documented for a number of glaciers around the world. Terra's ASTER instrument will be able to document how alpine glaciers around the world are changing.

Understanding of climate change requires complete observations of climate forcings. Present estimates of climate forcing that we know about since 1850 suggest that greenhouse gases are the largest cause of climate change. The net forcing is quite uncertain. There is the possibility that the negative forcing associated with aerosols and their effect on clouds significantly counteracts the positive forcing of greenhouse gasses, and also solar forcing may have contributed to climate change. Our understanding of how greenhouse gases are changing is not good enough to predict future climate change accurately.

In response to questions, Hansen said: There seems to be a small forcing by water vapor, probably from an increase in stratospheric water vapor. There are a number of different sources of methane

that are significant. There are speculations about slowdowns in methane sources and an increase of the sink, which is the OH radical in the atmosphere. The lifetime of methane is only a decade, so changes of the sources or sink can have an impact rather quickly.

Ocean Ecosystems and Climate Change

Mark Abbott, Oregon State University

Abbott said that there are large exchanges of heat between the atmosphere and oceans. Ocean ecology is usually thought of as a passive participant, but changes in circulation and upwelling can lead to local collapse. There are chemical gradients between surface and deep waters. The biological pump does not react directly to increases in atmospheric CO2. The only way you can change things is with shifts in ecosystems, change in type of organisms.
EOS provides global systematic coverage of remote regions and sampling of mesoscale processes.

In response to questions, Abbott said: Phytoplankton take up an estimated 2 gigatons of carbon per year due to primary production.

The Carbon Cycle and Anthropogenic Carbon Dioxide

Steven Wofsy, Harvard University

Wofsy discussed how CO2 concentrations have changed in the atmosphere. There is good evidence that the terrestrial biosphere is taking up lots of carbon. The pre-industrial concentration was 280 ppm. The current increase started in 1800 and it's up by 90 ppm. Some of the increase came from the destruction of the forests of North America. Over the past 20 years the terrestrial biosphere has taken up a significant amount of CO2 and stored it, most likely due to regrowth of these forests.

In response to questions, Wofsy said: A large amount of organic carbon is in soils in tundra and boreal forests. Boreal forests could add significant CO2 to the atmosphere over a 100-year time scale if this organic matter is oxidized to CO2 in response to climate warming. This process appears to be observed at a NASA-sponsored study site in Manitoba.

In response to questions, Wofsy noted that organic carbon is preserved in soil when peat or other types of organic matter are maintained under water or frozen and there can't be any biologic activity. Recent climate warming has apparently facilitated biological degradation of this stored material by thawing and drying it out

The Challenges of Reporting on Global Change Science

Robert Cowen-Christian Science Monitor

Cowen said that newspaper editors always ask journalists, "What's new?" "Why do I care?" The global warming story is s a long-playing thing and the story has been around forever. So reporters have to work at making new developments appear timely. Opposing scientists are a small factor, so why do they get so much time? If we are writing about a news story and we know that some of the stuff is considered on the fringe, you still have to put the fringe in. Maybe you only have a small chunk of space and time to write. We very much need to have strong voices in the mainstream that we can quote to balance the fringe material. If we're on a tight deadline, we do need these strong voices quickly available.

For more information on how to obtain presentation notes and/or NASA's Earth Observing System Global Change Media Directory, Contact Emilie Lorditch, elorditc@pop900.gsfc.nasa.gov.